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# Procurement Specification for the 242-A Evaporator Spare Reboiler

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**Abstract:** This specification provides the minimum requirements for the design and fabrication of the 242-A Evaporator Spare E-A-1 Reboiler. The 242-A Evaporator is located in the 200 East Area of the Hanford Nuclear Waste Site. Facility construction started in 1974 and operation began in 1977. The current and future mission of the 242-A Evaporator is to support environmental restoration and remediation of the Hanford Site by optimizing the 200 Area double-shell tank waste volumes through radioactive liquid waste volume reduction. Volume reduction is accomplished through an evaporation process that uses a conventional forced-circulation, vacuum evaporation system operating at low pressure to concentrate radioactive waste solutions.

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**APPROVED**  
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# Procurement Specification for the 242-A Evaporator Spare Reboiler

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## 1.0 SCOPE

This specification provides the minimum requirements for the design and fabrication of the 242-A Evaporator Spare E-A-1 Reboiler. The 242-A Evaporator is located in the 200 East Area of the Hanford Nuclear Waste Site. Facility construction started in 1974 and operation began in 1977. The current and future mission of the 242-A Evaporator is to support environmental restoration and remediation of the Hanford Site by optimizing the 200 Area double-shell tank waste volumes through radioactive liquid waste volume reduction. Volume reduction is accomplished through an evaporation process that uses a conventional forced-circulation, vacuum evaporation system operating at low pressure to concentrate radioactive waste solutions.

The 242-A Evaporator has been identified as a critical facility for continued and future Hanford operations. The reboiler (heat exchanger with vapor belt) is a critical component of the 242-A Evaporator, in which the reboiler's function is to transfer heat from steam to the waste. The current reboiler in operation is original to the facility, in which it has operated for almost 40 years. To minimize the impacts of a failed reboiler a certified spare is necessary.

For this scope, work includes design, fabrication, assembly, inspection, testing, documentation, packaging, and shipping of a single heat exchanger with vapor belt (reboiler) for the 242-A Evaporator Facility. The spare reboiler will be of similar design compared to the original reboiler currently installed in the 242-A Evaporator Facility, but the design will need to meet current requirements. All requirements in this specification and all references are to be applied to the reboiler.

Work does not include site services and installation or operation of equipment. The interfacing connectors, instrumentation and other appurtenances to be installed on the heat exchanger vessel nozzles are not within the scope of this specification.

## 2.0 APPLICABLE DOCUMENTS

### 2.1 GOVERNMENT DOCUMENTS

The following documents, of the exact issue shown in Table 2-1, form a part of the basis of design to the extent specified in the applicable sections of this document and establish the Code of Record (COR). In the event of a conflict between documents referenced herein and the requirements of this specification, the Buyer shall be notified to obtain interpretation and clarification.

**Table 2-1. Government Documents**

Document Number	Title
<b>Washington Administrative Code</b>	
WAC 173-303-640	<i>Tank Systems</i>

RPP-SPEC-60886, Rev. 1

Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement functions should be obtained from the contracting agency or as directed by the contracting agent.

## 2.2 NON-GOVERNMENT DOCUMENTS

The following documents of the exact issue shown in Table 2-2 form a part of this specification to the extent specified herein and establish the COR. In the event of a conflict between documents referenced herein and the requirements of this specification, the Buyer shall be notified for obtain interpretation and clarification.

If a revision number or document year is not given, then the Seller shall apply the latest issue, including addenda, at the time of request for quote (except standards referenced in Table U-3 of the ASME Boiler and Pressure Vessel Code [B&PVC] Section VIII, Division 1 shall be the year of acceptable edition listed therein).

**Table 2-2. Non-Government Documents**

<b>Document Number</b>	<b>Title</b>
<b>American Society of Mechanical Engineers (ASME)</b>	
ASME <i>Boiler and Pressure Vessel Code</i> , Section V (2015)	<i>Nondestructive Examination (NDE)</i>
ASME <i>Boiler and Pressure Vessel Code</i> , Section VIII, Div. 1 (2013)	<i>Rules for Construction of Pressure Vessels</i>
ASME NQA-1-2008 with 2009 Addenda	<i>Quality Assurance Requirements for Nuclear Facility Applications</i>
<b>American Society for Nondestructive Testing (ASNT)</b>	
ASNT CP-189 (2016)	<i>ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel</i>
ASNT SNT-TC-1A (2016)	<i>Recommended Practice No. SNT-TC-1A: Personnel Qualification and Certification in Nondestructive Testing</i>
<b>American Society for Testing and Materials (ASTM)</b>	
ASTM A615/A615M (2014)	<i>Specifications for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement</i>
ASTM A380 (2013)	<i>Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems</i>
ASTM A967 (2013)	<i>Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts</i>
<b>American Welding Society (AWS)</b>	
AWS QC1 (2007)	<i>Standard for AWS Certificate of Welding Inspectors</i>

Technical society and technical association specifications and standards are generally available for reference from libraries or they may be obtained directly from the Technical Society/Association.

### 2.3 NON-CODE OF RECORD DOCUMENTS

The following documents of the exact issue shown are utilized in, or referenced by this document, form a part of this specification to the extent specified herein but are not considered to be COR documents.

**Table 2-3. Non-Government Non-Code of Record Documents**

<b>Document Number</b>	<b>Title</b>
H-2-98988, Sheet 02, Rev. 19	<i>P&amp;ID Evap Recirc System</i>
HNF-14755, Rev. 6	<i>242-A Evaporator Documented Safety Analysis</i>
RPP-8360, Rev. 5	<i>Lifting Attachment and Lifted Item Evaluation , A Hanford Tank Operating Contractor Process</i>
RPP-RPT-52352, Rev. 2	<i>242-A Evaporator E-A-1 Reboiler – Functions and Requirements Evaluation Document</i>
TE-5769, Rev.0	<i>Heater with Vapor Belt</i>
TFC-BSM-IRM_DC-C-07, Rev A-7	<i>Vendor Processes</i>
WSRC-TR-2003-00172, Rev. 0	<i>Waste Feed Evaporation Physical Properties Modeling (U)</i>
WSRC-TR-2003-00210, Rev. 0	<i>Compositing, Homogenization, and Characterization of Samples from Hanford Tank 241-AN-107</i>

### 3.0 TECHNICAL REQUIREMENTS

#### 3.1 ITEM DEFINITION

The Reboiler is single-pass, counter flow, vertically orientated shell and tube heat exchanger. The reboiler includes a vapor belt on the steam inlet. Waste enters the Reboiler from the bottom of the heat exchanger, flows through the internal tubes where it exits at the top. A recirculation pump pushes the slurry through the Reboiler tubes at a linear velocity of about 8 ft/s. Counter flowing steam enters at the top of the reboiler on the shell-side and exits at the bottom of the exchanger as steam condensate.

##### 3.1.1 ITEM DIAGRAM

The as-built configuration of the reboiler is shown in drawing TE-5769<sup>1</sup>, *Heater W/ Vapor Belt*. Drawing TE-5769 provides the physical dimensions of the reboiler including shell, tube sheet, and tube bundle. Figure 3-1 is a picture of a similar built unit.

**Figure 3-1. Picture of Reboiler**



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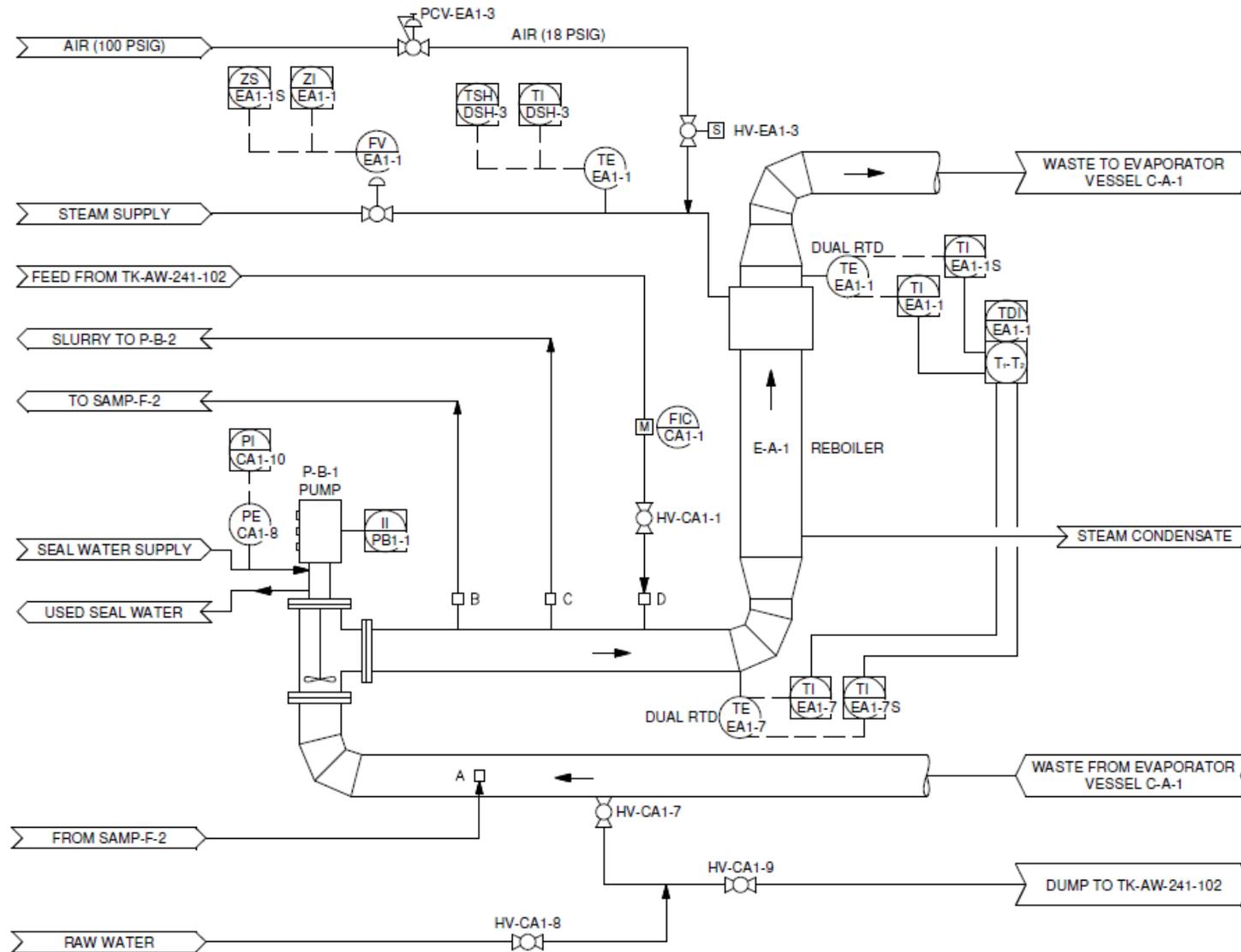
<sup>1</sup> The Buyer will provide two version of drawing TE-5769. One copy is the original as-built drawing from Process Equipment CO. Inc, and the other copy is a recent regenerated version of this drawing for legibility.

### 3.2 INTERFACE DEFINITION

The reboiler interfaces with a saturated steam system, steam condensate system, process air system and evaporation recirculation loop. Figure 3-2 provides a schematic of the reboiler. Appendix A provides a simplified schematic of the interfaces. Additionally, drawing H-2-98988, *P&ID Evap Recirc System*, provides the reboiler P&ID.

- ***Saturated Steam System Interface:*** Saturated steam is fed from a 16" feed line and enters the reboiler through the top 18" nozzle (identified as N47 in TE-5769) at a pressure of 15 psig and temperature of 250°F. This steam is used for heating and is on the shell side of the reboiler.
- ***Process Air System Interface:*** Process air is delivered to the reboiler at 18 psig. The process air supply piping is connected to the steam piping (air enters the reboiler through nozzle N47). Either process air or steam is delivered to the reboiler at any specific time (e.g., when process air is delivered, steam is isolated).
- ***Steam Condensate System Interface:*** Steam condensate exits the reboiler through the bottom 4" nozzle (identified as N49 in TE-5769). Steam condensate is on the shell side of the reboiler
- ***Evaporator Recirculation Waste Loop Interface:*** The evaporator recirculation loop is maintained at a pressure between 40 to 80 torr, which allows water to boil off at the surface of the heated slurry at a temperature of approximately 122 °F (this evaporation occurs in a separated evaporation vessel). Waste continuously enters the loop at about the same rate that water is evaporated, until the slurry within the loop is concentrated to a specific density. Waste is introduced into the evaporator recirculation loop at temperature is about 65 °F, where it blends with slurry liquid (concentrated waste). This blend then enters the reboiler where it is heated.

Figure 3-2. Process Slurry Reboiler



### 3.3 CHARACTERISTICS

#### 3.3.1 Functional Characteristics

The function of the reboiler is to transfer heat from steam to waste.

#### 3.3.2 Physical Characteristics

##### 3.3.2.1 Reboiler Physical Characteristics

The reboiler is a vertical unit that consists of 364 tubes, each having a 14 ft-1/8 in. length and a 1.5 in. outside diameter (OD), arranged with a 1-7/8 in. triangular pitch. The tubes are encased by a 40.5 in. OD, 15-ft long stainless steel shell. The reboiler has three equally spaced baffles, as well as an impingement baffle at the steam inlet to distribute steam vapor evenly. The total heat transfer surface area is approximately 2,000 ft<sup>2</sup>.

The as-built configuration and dimensions of the reboiler are provided in TE-5769. The reboiler will be installed in an existing recirculation loop in which the piping has little tolerance for modification. Therefore the **critical dimensions** of the reboiler are the dimensions that affect the interface points of the reboiler with the recirculation loop piping which include:

1. Steam Inlet Nozzle
2. Steam Condensate Outlet Nozzle
3. Outside Diameter of the Reboiler
4. Length of the Reboiler

The Seller is responsible for identifying any modification to the reboiler that can affect the critical dimensions. The Buyer shall review and approve any of these modifications.

#### 3.3.3 Waste Physical Characteristics

The physical characteristics of the waste are provided in Table 3-1.

**Table 3-1. Waste Physical Characteristics**

Parameter	Unit	Value/Range
Specific Gravity <sup>a</sup>	g/ml	1.0 – 1.5
Viscosity <sup>d</sup>	Centipoise (cP)	1-10
Temperature <sup>a</sup>	°F	65-150
Thermal Conductivity <sup>b</sup>	-	-
Specific Heat <sup>c</sup>	J/g-°C	3.39
pH <sup>a</sup>	-	~13

<sup>a</sup> These values originate from HNF-14755, *242-A Evaporator Documented Analysis*, Rev. 6.

<sup>b</sup> For thermal conductivity use the thermal conductivity of water. In WSRC-TR-2003-00172, *Waste Feed Evaporation Physical Properties Modeling (U)*, Rev. 0, simulation and experimental data predict a thermal conductivity equal to that of water within the error of experimental measurements and the error of the trial model fits of the simulation data.

<sup>c</sup> This value originates from Table 6-2 of WSRC-TR-2003-00210, *Compositing, Homogenization, and Characterization of Samples from Hanford Tank 241-AN-107*, Rev. 0.

<sup>d</sup> Values based on Table 9 of WSRC-TR-2003-00172.

### 3.3.4 Waste Chemical & Radiological Composition

The reboiler processes mixed waste (i.e., waste containing both radioactive and hazardous components), in which the physical, chemical and radiological characteristics vary greatly from one campaign to the next. In general, the feed is a highly-alkaline liquid (See Table 3-1). The primary chemical constituents are sodium hydroxide, sodium nitrate, sodium nitrite, sodium carbonate, sodium aluminate, and sodium sulfate. Small quantities of organic chemicals are also present.

The principal radionuclides in the feed are <sup>90</sup>Sr and <sup>137</sup>Cs. Minor concentrations of <sup>3</sup>H, <sup>14</sup>C, <sup>79</sup>Se, <sup>99</sup>Tc, and other fission products and trace quantities of uranium, <sup>239</sup>Pu, and <sup>241</sup>Am are also present.

### 3.3.5 Reliability

To meet reliability requirements, the following concepts shall be used:

- a) The reboiler shall be designed for a useful life of 40 years.
- b) The reboiler's operation consists of intermittent operation of about 4 evaporator campaigns per year, in which each campaign lasts about 336 hrs each (2 weeks) for a total of 1350 hours of operation per year.

### 3.3.6 Maintainability

- a) The reboiler will be welded into a recirculation loop in a high radiation environment that cannot be serviced or repaired. No design changes to the reboiler design shall be made that result in the need of maintenance.

### 3.3.7 Environment

The following are the ambient conditions for which the heat exchanger shall be designed:

Temperature, °F:	65 to 82
Pressure:	Atmospheric
Relative humidity, %:	15 to 90

### 3.3.8 Safety

- a) The reboiler is considered a safety significant component. The tube bundle/tube sheet provide confinement of radioactive and chemically hazardous waste from entering the steam condensate system. The reboiler's surfaces that come in contact with the waste (e.g., tube bundle) shall maintain a leak tight pressure boundary.
- b) The Reboiler shall be designed to keep radiation exposure to personnel as low as reasonable achievable (ALARA). Crevices and pockets where radioactive material could accumulate and sources of airborne activity shall be avoided.
- c) Overpressure protection of the reboiler is provided at the facility per ASME requirements.

## 3.4 DESIGN AND CONSTRUCTION

### 3.4.1 Industry and Government Standards

- a) The Reboiler shall be designed, fabricated, examined, inspected, tested, and certified to the requirements of ASME B&PVC, Section VIII, Division 1. The reboiler shall be Code Stamped and registered with the National Board of Boiler and Pressure Vessel Inspectors. The Manufacturer shall provide the Form U-1 form as a deliverable.
- b) The recommendations of TEMA Class "C" (General Service) shall be implemented during the design & construction of the reboiler.
- c) The Reboiler design shall comply with the requirements of Washington Administrative Code (WAC) 173-303-640, *Tank Systems*. The Buyer will furnish services for an independent qualified registered professional engineer (IQRPE) to review the reboiler design to ensure the design complies with WAC 173-303-640.

### 3.4.2 Design Analysis

There are no calculations available for the design of the original reboiler. Limited information for the reboiler exist which includes the as-built drawing. The goal is to procure a reboiler of similar design with the required design documentation to meet ASME B&PVC, Section VIII, Division 1 requirements. The design shall meet the following requirements:

- a) Design analysis shall be performed per ASME B&PVC, Section VIII, Division 1. All calculations required by the code shall be documented and submitted in a reboiler design report.
- b) Additionally, the design report shall also include a lift analysis (See Section 3.4.5) and thermal stress analysis (See Section 3.4.6).
- c) Calculations shall be sufficiently detailed that a person technically qualified in the subject can review and understand the analyses and verify adequacy without recourse to the originator.

### 3.4.3 Design Parameters

The following parameters shall be used for design:

Shell Side Pressure	100 psig
Tube Side Pressure	Full Vacuum & 20 psig
Shell Side Temperature:	300 °F
Tube Side Temperature:	250 °F
Flow through reboiler (slurry):	~13,000 gallons/min max

Note:

- (1) The pressure and temperature design values originate from the design data for the original reboiler and the critical characteristics identified in RPP-RPT-52352, 242-A *Evaporator E-A-1 Reboiler – Functions and Requirements Evaluation Document*, Rev. 2.
- (2) The flow rate through the reboiler originates from HNF-14755.

### 3.4.4 Materials

- a) All materials used shall comply with the material specifications shown in the Parts List Table in drawing TE-5769. Table 3-2 are the material specifications for major components of the reboiler. Note additional material specifications are provided in TE-5769.

**Table 3-2. Material Specifications**

Item	Material Specification
Shell	SA-240 304L
Tube Sheet	SA-240 304L
Baffles	SA-240 304L
Tubes	SA-213 304L

- b) Any weld filler material shall be compatible with stainless steel 304L, such as 308L

### 3.4.5 Lift Analysis

- a) The lifting attachment(s) on the re-boiler shall be designed in accordance with Sections 6.2 and 6.3 of RPP-8360, *Lifting Attachment and Lifted Item Evaluation, A Hanford Operating Contractor Process*. The design shall consider the equipment orientation, i.e., horizontal to vertical for lifting.
- b) Lifting instructions and lift diagrams shall be provided by the Seller. The lift diagram must show estimated weight and center of gravity. The lifting lugs must also be shown in the design drawing.
- c) The lift analysis must show that the reboiler can be lifted without distortion, damage or exceeding the allowable stresses.
- d) The reboiler shall be shipped in accordance with the applicable DOT standards. Transport and tie-down instructions and diagrams shall be provided. Lift points shall not be used for transport tie-downs. Transport tie-down points shall be identified on the equipment. Calculations shall be required for the design of all transport tie-down attachment points.

### 3.4.6 Thermal Stress Analysis

- a) A thermal stress analysis shall be performed for the reboiler design. The bounding condition for the Thermal Stress Analysis shall use the following parameters:

Shell Side Pressure:	15 psig
Tube Side Pressure:	Full Vacuum
Shell Side Temperature:	250 °F
Tube Side Temperature:	43°F
Shell Side Fluid:	Sat. Steam
Tube Side Fluid:	Water
Shell Side Mass Flow Rate:	27,000 lb/hr (max)
Tube Side Fluid Flow:	14,000 gpm

### 3.4.7 Welds / Critical Welds

- a) TE-5769 does not contain sufficient weld information. The Seller is responsible for the selection of all welds for the reboiler.
- b) The Joint Efficiency (E) shall be as specified on Buyer approved fabrication drawings and per ASME Section VIII, Div 1, UW-12. As a minimum, butt welded joints shall be examined by 10% radiography in accordance with ASME Section VIII, Div 1.

- c) All critical welds on the equipment shall be identified in the design media. For the purpose of this requirement, critical welds are defined as those welds whose failure could result in loss of load, loss of load control or loss of waste confinement (e.g., welds required to maintain leak-tight pressure boundary).

### 3.4.8 Corrosion of Parts & Protective Coatings

- a) The original reboiler was built with a corrosion allowance of 0" in. for both the shell side and tube side. The Seller shall provide a recommendation of the appropriateness of this corrosion allowance depending on standard operating conditions and expected life expectancy of the reboiler.
- b) The reboiler shall not be coated with any protective coating (e.g. painted).

### 3.4.9 Fabrication Requirements

- a) The reboiler's internal tubes shall be of seamless construction.
- b) When rolling austenitic stainless plate, care shall be taken to prevent carbon pickup or contamination of the rolled material. The work area shall be free of carbon steel grindings and general cleanliness shall be maintained to preclude carbon contamination.
- c) If sufficient evidence exists that carbon contamination of the reboiler materials has occurred, the Buyer, at his discretion may request that the Manufacturer perform a free iron test per ASTM A967, *Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts*, Section 19, Practice F. If the test results are positive for free iron, the Manufacturer shall passivate the entire reboiler per the requirements of ASTM A967 and/or ASTM A380, *Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems*.
- d) Machining or grinding of stainless steel shall be done with tools that never come in contact with materials other than stainless steel. Wire brushing of stainless steel shall be done only with stainless steel brushes that have not previously been used on materials other than stainless steel.
- e) Clamps, wedges, temporary clips, etc., welded to, or mechanically fastened in contact with, stainless steels shall be made of stainless steel only.
- f) The Manufacturer shall produce a weld map identifying each weld joint by weld number for every fabricated component. The weld record shall identify components with item number and contain, at a minimum the following information:
- Weld map
  - Weld procedure identification, including applicable revision
  - Acceptance criteria
  - Fit-up inspection, if required

- Welder identification
- Filler metal type and heat numbers
- Base metal type and heat numbers
- NDE method and results
- Inspector identification (i.e., printed name/signature/stamp, and date).

#### **3.4.10 Identification and Marking**

- a) The identification marks for each piece of steel shall be maintained until final acceptance of fabrication is made. The identification marks shall be transferred to each piece as subdivided for fabrication and shall include (1) manufacturer's identification, (2) alloy type, and (3) heat number.

#### **3.4.11 Nameplate**

- a) The Manufacturer's ASME nameplate, with required markings including the official Certification Mark with the U Designator, shall be mounted in the location shown on the Buyer approved fabrication drawings.

## 4.0 QUALITY ASSURANCE REQUIREMENTS

### 4.1 QUALITY ASSURANCE GENERAL REQUIREMENTS

- a) Work performed on this contract shall be in accordance with a documented Quality Control System/Quality Assurance Program and implementing procedures that meet the requirements of ASME NQA-1-2008 with 2009 Addenda, *Quality Assurance Requirements for Nuclear Facility Application*.
- b) The Manufacturer shall hold a Certificate of Authorization with the “U” Designator.
- c) A Certified Material Test Report (CMTR) shall be provided for all materials specified to an ASME or ASTM material standard.
- d) A Certificate of Conformance (COC) shall be provided for all materials not specified to an ASME or ASTM material standard.

### 4.2 INSPECTIONS AND TESTS

- a) The Manufacturer shall prepare and submit a fabrication, inspection, and test (FIT) plan for the reboiler for Buyer review, approval, and insertion of Buyer-designated source inspection/witness points prior to starting fabrication, examination, inspection, or testing on the reboiler. The FIT plan shall be reviewed and approved by the Buyer prior to the start of fabrication.
- b) Prior to the performance of any test, the Seller shall submit a procedure for each test to the Buyer for review and approval. Test information recorded or calculated shall be documented and submitted to the Buyer.
- c) A hydrostatic pressure test shall be performed and witnessed by the buyer’s representative. The hydrostatic test requirements are:
  - a. The hydrostatic tests shall follow ASME B&PVC, Section VIII, Div. 1, Article UG-99 guidelines.
  - b. The test pressure shall be held for a minimum of one hour.
  - c. Potable water used for hydrostatic testing shall not contain more than 200 ppm chlorides.
- d) Radiographic examination (RT), ultrasonic methods for welds (UT), magnetic particle examination (MT) and liquid penetrant examination (PT) shall be performed in accordance with ASME B&PVC, Section VIII, Division 1, and ASME B&PVC, Section VIII Section V, *Nondestructive Examination*, requirements.
- e) The Manufacturer shall perform 10% RT on all critical welds, including all longitudinal welds and circumferential welds.

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- f) Reboiler examinations/inspections and tests in accordance with ASME B&PVC, Section VIII, Division 1, UG-90 through UG-99, UG-102, and UG-103 are required.
- g) Verification shall be performed all on critical dimensions. The Buyer will provide critical as-built dimensions of the existing reboiler and required ASME B&PVC Section VIII Div. 1 tolerances to the Manufacturer. Verify location and dimensions that affect interface point of the reboiler (e.g., steam inlet and steam condensate outlet nozzles) are in accordance with the Buyer approved fabrication drawings.
- h) Visual weld examination shall be performed by an AWS QC-1, *Standard for AWS Certificate of Welding Inspectors*, Certified Weld Inspector (CWI).
- i) Nondestructive examination (NDE) shall be performed by personnel certified to the requirements of ASNT SNT-TC-1A, *Recommended Practice No. SNT-TC-1A: Personnel Qualification and Certification in Nondestructive Testing*.
- j) The interpretation of the results shall be by either a Level II or Level III examination personnel certified to ASNT SNT-TC-1A.
- k) NDE reports and radiographs shall be traceable to the item examined, include all essential examination parameters, and signed and dated by the NDE examiner. These reports and radiographs shall be submitted for approval by the Buyer prior to shipment of completed items.
- l) The Manufacturer shall submit all nonconformance reports (NCRs) that specify “Use-As-Is” or “Repair” to the Buyer with a proposed disposition for approval. Work related to that NCR shall not proceed until the NCR disposition is approved by the Buyer.
- m) For measuring and test equipment (M&TE) used in examination/inspections and testing, the Manufacturer shall provide legible, reproducible copies of Certificates of Calibration traceable to the National Institute of Standards and Technology or other documented evidence must be submitted stating the basis of the calibration. This is not required for commercial equipment such as timing instruments, rulers, tape measures, and levels, if such equipment provides the required accuracy.
- n) For any raw materials (weld filler material, steel plate, rod, etc.) upgraded by the fabricator using commercial grade dedication, the dedication plan shall be submitted to the Buyer for written approval prior to procurement of said material.

## 5.0 DOCUMENT SUBMITTAL (VENDOR INFORMATION)

Required submittals are identified and listed on the procurement Master Submittal Register (MSR). Table 5-1 provides a summary of these submittals. The MSR identifies the minimum submittals required by this specification and identifies when the submittals are required to be submitted in the procurement process. The MSR included with the purchase order will constitute the governing MSR.

Submittals shall be provided using the TOC Incoming Letter of Transmittal (form A-6005-315). All transmittal subject headings shall contain, at a minimum, the subcontract number, submittal number identified by the MSR, and submittal description.

Submittals shall be provided in electronic format unless available only as a hard copy. Electronic submittals may be sent to TOCVND@rl.gov or delivered via a WRPS designated File Transfer Protocol (FTP) site. Electronic formats must be non-password protected in one of the following formats:

- Microsoft<sup>®2</sup> Office Compatible
- Portable Document Format (PDF)
- Tagged Image File Format (TIFF)
- Graphics Interchange Format (GIF)
- Joint Photographic Experts Group (JPEG)
- Windows Media Video (WMV)
- Standard for the Exchange of Product Model Data (STEP)
- Moving Picture Expert Group (MPEG)
- Extensible Markup Language (XML)
- HyperText Markup Language (HTML)
- Comma Separated Values (CSV)
- Text (TXT)
- Initial Graphics Exchange Specification (IGES)

All deliverable documentation shall be complete, accurate, legible, and reproducible. Before delivery, design media and documents shall be reviewed by qualified Subcontractor personnel for technical adequacy and appropriate content in accordance with the Subcontractor's Quality Assurance procedures. The Subcontractor shall attest, in writing, to the accuracy and completeness of the information contained in the final deliverables.

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<sup>2</sup> Microsoft is a registered trademark of Microsoft Corporation, Redmond, Washington

**Table 5-1. Summary of Submittals**

Item	Title	Purpose	When required
1	Quality Assurance Program	Pre Evaluation	Per MSR
2	ASME Certificate of Authorization for U Designator	Pre Evaluation	Per MSR
3	Work Plan and Design/Fabrication Schedule	Pre Evaluation	Per MSR
4	Initial Reboiler Design Report	Approval	Per MSR
5	Fabrication, Inspection, and Test Plan	Approval	Per MSR
6	Welder Performance Qualifications	Approval	Per MSR
7	CWI Certifications, including Current Eye Test	Approval	Per MSR
8	Welding Procedure Specifications and Applicable Procedure Qualification Records	Approval	Per MSR
9	NDE Personnel Certification Records, including Current Eye Test	Approval	Per MSR
10	All NDE Procedures, including Visual	Approval	Per MSR
11	Reboiler Fabrication Drawings	Approval	Per MSR
12	Test Procedures	Approval	Per MSR
13	Certified Test Data and Reports	Approval	Per MSR
14	CGD Plan for Raw Materials, if applicable	Approval	Per MSR
15	M&TE Calibration Reports	Approval	Per MSR
16	Inspections and Examination Results	Approval	Per MSR
17	Radiography Film & Associated Reader Sheets	Approval	Per MSR
18	Preservation, Packaging, Shipping, Storage and Lifting Plan	Approval	Per MSR
19	Final Reboiler Design Report with As-Built Drawings	Information	Per MSR
20	Signed ASME Form U-1 for Reboiler	Approval	Per MSR

## 5.1 APPROVAL OF SUBMITTALS

All Submittals transmitted shall include the designation in the Master Submittal Register (MSR) per TOC Vendor Processes stated in TFC-BSM-IRM\_DC-C-07, *Vendor Processes*. Submittals are divided into two types: 1) those requiring “approval” (e.g., approval data or pre-purchase evaluation data); and 2) those “not requiring approval” (e.g., vendor information data). Submittals “not requiring approval” will be reviewed to verify completeness and adequacy for their intended purposes. A submittal requiring approval that is not approved is identified as: 1) “Not Approved Revise and Resubmit.” The submittal is considered technically deficient, or incomplete, and therefore unacceptable. Resubmittal is required, hence the fabrication, procurement, or performance of procedures shall not proceed; or 2) “Approved with Exception.” Fabrication, procurement, and performance may proceed, and resubmittal is required to verify incorporation of the exception. Submittals “not requiring approval” that are determined to be

incomplete or inadequate will be marked “Resubmit.” An explanation of the deficiencies will be included for corrective action by the Seller.

Approval by the Buyer does not relieve the Seller of responsibility for accuracy or adequacy of design under this specification.

If any revision has been made to previously submitted items, the Seller shall resubmit updated versions of said items for approval, in addition to the items listed above.

Certified data shall be defined to mean that the design adequacy of a given item (document, drawing, calculation, etc.) be verified by persons other than those who prepared the item. Each deliverable (drawing, calculation, etc.) shall have at least an originator's/preparer's signature and a checked-by or approved by signature.

## **5.2 LIST OF SUBMITTALS**

This list of submittals along with relevant dates shall be kept as part of the MSR.

Identify each submittal by the purchase order number and Seller's identification number.

1. Quality Control System/Quality Assurance Program
2. ASME Certificate of Authorization for U Designator
3. Work Plan and Design/Fabrication Schedule
  - a. Work Plan: Submit a work plan showing design & fabrication approach.
  - b. Design/Fabrication Schedule: Submit a schedule showing design, fabrication, assembly, testing and shipment of the equipment after receipt of the order.
  - c. Detailed, dimensioned drawings, with specification information.
4. Initial Reboiler Design Report.
  - a. ASME Calculations.
  - b. 3-dimensional computer aided design solid body model of the reboiler.
  - c. Bill of Materials.
  - d. Detailed, dimensioned drawings, with specification information.
  - e. Lift Analysis
  - f. Thermal Stress Analysis
5. Fabrication, Inspection, and Test Plan.
6. Welder Performance Qualifications

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7. Certified Weld Inspector Certifications including current Eye Test
8. Welding Procedure Specifications and Applicable Procedure Qualification Records
9. NDE Personnel Certification Records including current Eye Test
10. All NDE Procedures, including Visual.
11. Reboiler Fabrication Drawings
12. Test Procedures. The following information shall be submitted:
  - a. Hydrostatic Test Procedure
13. Certified Test Data and Reports. The following test data and reports shall be submitted. Once approved, the test results shall become part of the Final Reboiler Design Report.
  - a. Hydrostatic Test Results
  - b. Certified Material Test Reports
14. Commercial Grade Dedication Plan for Raw Materials, if applicable
15. M&TE Calibration Reports
16. Inspection and Examination Results.
17. Radiography Film & Associated Reader Sheets
18. Preservation, Packaging, Shipping, Storage and Lifting Plan. Approved plan shall become part of the Final Reboiler Design Report.
19. Final Reboiler Design Report, including approved Items 7 through 17. Complete documentation and record of reboiler. Final Reboiler Design Report shall include as-built drawings, including:
  - a. Final detailed, dimensioned drawings, with specification information.
  - b. Bill of Materials
  - c. 3-dimensional computer aided design solid body model of the reboiler
  - d. ASME B&PVC Section VIII Div. 1 Calculations/Analysis
  - e. Lift Analysis
  - f. Thermal Stress Analysis
20. Signed ASME Form U-1 for Reboiler (Manufacturer's Data Report for Pressure Vessel).

## **6.0 PREPARATION FOR DELIVERY**

### **6.1 GENERAL**

- a) The reboiler will require packaging to protect against physical damage, or any effect that would affect quality or cause deterioration during shipment, handling and storage.
- b) Perform and document a final external inspection of reboiler to ensure that all markings and identifications are present per the requirements of the drawings and this specification.
- c) The Manufacturer shall submit a packaging and shipping plan for Buyer review and approval. The plan shall include cleaning and inspections identified by this specification.

### **6.2 CLEANNESS AND FOREIGN MATERIAL EXCLUSION**

- a) Cleanliness criteria shall conform to ASME NQA-1-2008, Subpart 2.1, "Cleanliness Class B for Corrosion Resistant Alloys."
- b) Cleaning of the reboiler interior shall be performed after hydrostatic testing and post-test examinations are complete.
- c) Cleaning of accessible internal and external surfaces shall be performed mechanically or by water flushing. Remove loose dirt, grease, scale and debris by documented cleaning methods approved by the Buyer.
- d) All visible water shall be removed from cleaned internal surfaces. Drying methods can be clean rags and/or oil free compressed air.
- e) Mechanical cleaning tools used on stainless steel shall not have been previously used on carbon steel or any other materials that would contaminate stainless steel surfaces.

### **6.3 PRESERVATION AND PACKAGING**

- a) Packaging and shipping shall be in accordance with ASME NQA-1-2008 (including 1a 2009 Addendum), Subpart 2.2, for Level C items.
- b) All openings shall be sealed in such a manner as to exclude dust, water or other contaminants until material is placed in storage at the point of delivery. The Manufacturer shall install securely applied protective covers over the reboiler in preparation for shipping.
- c) The reboiler shall be dried and cleaned to protect against rust and corrosion.
- d) The reboiler shall be protected from dirt, soil, and moisture and packaged for long-term storage outdoors.

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- e) The reboiler shall be packaged to eliminate damage during shipping, handling, and storage.
- f) Temporary bracing, fixtures, or hardware installed to stabilize furnished items during shipment or handling (excluding packaging materials) shall be tagged or otherwise identified so that it can be removed before installation or operation of the item.

**6.4 MARKING**

- a) Packages shall be suitably marked on the outside to facilitate identification of the purchase order, the procurement specification, the package contents, and any special handling instructions.

**6.5 HANDLING**

- a) During handling, no carbon steel tools, slings, cradles or other carbon steel materials shall be allowed to contact components made of stainless steel.
- b) The handling and storage of materials shall not result in their physical damage.

**6.6 SHIPPING**

- a) The reboiler shall be shipped in the horizontal position. The Manufacturer shall prevent carbon steel contamination during shipping.
- b) The reboiler shall be secured for shipping utilizing web tie-downs of sufficient strength and quantity to prevent the load from shifting in transit. Protective cushions shall be provided for all points the web contacts stainless steel surfaces to prevent abrasion to the surface finish.

## 7.0 NOTES

### 7.1 LIST OF ACRONYMS

ALARA	as low as reasonably achievable
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society of for Nondestructive Testing
ASTM	American Society for Testing and Materials
AWS	American Welding Society
B&PVC	Boiler and Pressure Vessel Code
COR	Code of Record
CWI	Certified Weld Inspector
FIT	fabrication, inspection, and test plan
NCR	nonconformance reports
NDE	nondestructive examination
M&TE	measuring and test equipment
MSR	master submittal report
MT	magnetic particle testing
OD	outside diameter
PT	liquid penetrant examination
RT	Radiographic examination
UT	ultrasonic methods for weld testing

**8.0 APPENDIX A- SIMPLIFIED INTERFACE SCHEMATIC**

Figure 8-1. Simplified 242-A Reboiler and Interfacing Systems

